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Applicant: Tippins et al.

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Sir:

Transmitted herewith for filing under 37 C.F.R. § 1.53(c) is the provisional patent application of:

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Enclosed are:

[X] Specification (23 pages).

[X] Informal drawings (4 sheets, Figures 1-5).

[X] Application Data Sheet (37 CFR 1.76).

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U.S. PROVISIONAL APPLICATION

for

MIXING DRUM

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MIXING DRUM

BACKGROUND OF THE INVENTION

Front discharge concrete mixing drums generally extend above a cab of a vehicle and discharge concrete at a front of a vehicle. Because such drums must extend over and above the cab, front discharge drums are extremely long, typically requiring extra sections which must be bolted together. This extra length subjects portions of the drum to greater stresses and creates additional seams where concrete can collect. As a result, cleaning of the front discharge drum is even more tedious and time consuming as compared to cleaning the interior of rear discharge drums. In addition to collecting on the interior of the concrete mixing drum, concrete also frequently collects on the exterior of the drum. Collection of concrete on the exterior of the drum further increases the time and cost of cleaning the drum.

DESCRIPTION

FIGURE 1 is a side elevational view of a concrete mixing truck 10 which generally includes chassis 12, cab 14, drum 16, mixing drum and drum drive 17, and delivery system 18. Chassis 12 generally supports and power the remaining components of truck 10 and generally includes frame 20, power source 22, drivetrain 24 and wheels 26. Frame 20 provides mixing truck 10 with the structural support and rigidity needed to carry heavy loads of concrete. Power source 22 is coupled to frame 20 and generally comprises a source of rotational mechanical energy which is derived from a stored energy source. Examples include, but are not limited to, an internal combustion gas-powered engine, a diesel engine, turbines, fuel cell driven motors, an electric motor or any other type of motor capable of providing mechanical energy.

For purposes of this disclosure, the term "coupled" means the joining of two members directly or indirectly to one another. Such joining may be stationary in nature or

moveable in nature. Such joining may be achieved with the two members or the two members and any additional intermediate members being integrally formed as a single unitary body with one another or with the two members or the two members and any additional intermediate members being attached to one another. Such joining may be permanent in nature or alternatively may be removable or releasable in nature.

Drivetrain 24 is coupled between power source 22 and wheels 26 and transfers power (or movement) from power source 22 to wheels 26 to propel truck 10 in a forward or rearward direction. Drivetrain 24 includes a transmission 25 and a wheel end reduction unit 27. Both transmission 25 and wheel end reduction unit 27 utilize a series or set of gears to adjust the torque transmitted by power source 22 to wheels 26. One example of a wheel end reduction unit is described in copending U.S. Patent Application Serial No. 09/635,579, filed on August 9, 2000, by Brian K. Anderson entitled NON-CONTACT SPRING GUIDE, the full disclosure of which is hereby incorporated by reference and attached as Appendix F.

Cab 14 is coupled to chassis 12 and includes an enclosed area from which an operator of truck 10 drives and controls at least some of the various functions of truck 10.

Drive assembly or drivetrain 18 is operatively coupled to power source 22 and mixing drum 16 and uses the power or movement from power source 22 to provide a rotational force or torque to mixing drum 16. According to an alternative embodiment, the drivetrain may be powered by a source other than power source 22 that is provided on truck 10.

Mixing drum 16 contains concrete or other material mixed by truck 10. Mixing drum 16 includes barrel 30, projections 32 (shown in FIGURES 2 and 3), drive ring 34, roller ring 36 and a hatch cover assembly (not shown). Barrel 30 is an elongate container having an opening 38 at a first axial end 40 and drive ring 34 coupled to an opposite axial end 42. Barrel 30 includes a main tear-drop or pear-shaped portion 44 and a frusto conical funnel-shaped snout portion 46. Main portion 44 provides a majority of interior volume of barrel 30 and has a generally convex exterior surface 48. Snout portion 46 has a generally linear tapered surface 50. Surfaces 48 and 50

merge together at a concave intermediate portion 54. As shown by FIGURE 1, snout portion 46 extends from main portion 44 over and above cab 14 generally terminates at opening 38. Opening 38 communicates with the interior of drum 16 which has overall interior surface 56 (shown in FIGURE 2) provided by an interior surface 58 of barrel 30 and an exterior surface of projections 32 (shown on FIGURES 2 and 3). As will be described in greater detail hereafter, the interior surface 56 of drum 16, and more particularly, interior surface 58 of barrel 30 and the exterior surface 60 of projections 32 are configured to inhibit adherence of concrete and other aggregate to such surfaces. Exterior surfaces 48 and 50 of barrel 30 are also configured to provide a smooth surface which inhibits collection of concrete and other aggregate.

Projections 32 (shown on FIGURES 2 and 3) spirally extend within the interior of barrel 30 and project from interior surface 58 of barrel 30. Projections 32 (also known as fins, blades, veins, screws or formations) are specifically configured to move concrete and aggregate within barrel 30 towards opening 38 when drum 16 is rotated in the first direction. Conversely, projections 32 are configured to move concrete and aggregate towards end 42 to mix the concrete when drum 16 is rotated in a second opposite direction.

Drive ring 34 (also known as a sprocket, spider, daisy, etc.) is located at end 42 of barrel 30 and is configured to operably couple drum 16 to drum drive 17. Roller ring 36, a circular annular member that fits around the exterior of barrel 30 of drum 16 at a location generally between ends 40 and 42. Roller ring 36 is configured to serve as a surface against which rollers 64 coupled to frame 20 ride as drum 16 rotates. Examples of potential constructions for drive ring 34 and roller ring 36 are found in copending International Patent Application Serial No. PCT/US03/25656 entitled Mixing Drum and filed on August 15, 2003 by Anthony Khouri, William Rogers and Peter Saad, wherein the entire disclosure of this application is hereby incorporated by reference and attached as Appendix A.

Drum drive 17 (also known as drive assembly) is operatively coupled to power source 22 and mixing drum 16. Drum drive 17 transmits power or movement from power

source 22 to provide a rotational force or torque to rotate drum 16. An example of one embodiment of the drum drive 17 is disclosed in U.S. Patent 5,820,258 entitled Cement Mixer Drum Support which issued on October 13, 1998, the full disclosure of which is incorporated by reference and attached as Appendix B.

Delivery system 18 generally comprise one or more structures positioned adjacent to end 40 of drum 16 which are configured to receive concrete and aggregate through opening 38 and to deliver the concrete or aggregate to a desired location. Delivery system 18 includes spout 66 and chute 68. Spout 66 funnels concrete into chute 68 which guides the flow of concrete or other aggregate within a channel to a desired location.

FIGURES 2 through 5 illustrate barrel 30 and projections 32 in greater detail. FIGURE 2 is sectional view of drum 16 while FIGURE 3 is the same sectional view of drum 16 including shading. FIGURE 4 is an enlarged fragmentary sectional view of drum 30 and projections 32. FIGURE 5 is an enlarged fragmentary sectional view of drum 30 of FIGURE 4 taken along a line 5--5. In the particular example illustrated in FIGURES 2 through 5, drum 16 is substantially formed from two major layers 74, 76 of material that extend across an axial midpoint of drum 16 and particularly extend from end 40 to end 42. Layers 74 and 76 generally serve to provide the main structure of drum 16. Although not illustrated, additional non-structural layers or coatings may additionally be added. For example, relatively thin paint, decals, coatings or other non-structural layers may be further applied to the exterior of layer 76. For purposes of this disclosure, the use of the term "exterior" with reference to barrel 30 or drum 16 generally refers to the exterior of layer 76 despite the potential presence of additional non-structural layers over top of layer 76, such as decals, paint, coatings or other non-structural layers. Because layers 74 and 76 extend across an axial midpoint of drum 16 and nominally extend from end 40 to end 42, drum 16 has improved structural strength along the axial length between main portion 44 and snout portion 46. In addition, because layers 74 and 76 continuously and integrally extend as unitary bodies from end 40 to end 42, drum 16 lacks seams or joints where sections would otherwise be bolted or fastened together. As a result, drum 16 lacks interior

corners where concrete or aggregate may collect, making cleaning easier. At the same time, exterior of drum 16 also lacks surface discontinuities, outwardly projecting flanges (other than roller ring 36), or other abrupt surface contours where concrete and aggregate may collect, further simplifying cleaning of drum 16.

Layer 74 generally comprises a polymer impregnated or infused with a slip agent. For purposes of this disclosure, the term "slip agent" refers to any substance, whether in solid or liquid form that when mixed with a polymer reduces the coefficient of friction of the polymer along its surface as compared to the same polymer without the substance. In one particular embodiment, the slip agent has a surface energy less than the surface tension of a Portland Cement low slump concrete. In another embodiment, the slip agent has a surface energy of less than about 20 dynes per centimeter. In one embodiment, the slip agent is configured so as to not substantially migrate within the polymer. As a result, the slip agent does not migrate to a boundary between layers 74 and 76 which could present lamination issues. In one embodiment, the slip agent is a polyundecene. In another embodiment, the slip agent is a polyalphaolefin. In another embodiment, the slip agent is polytetraflourethylene. In other embodiments, other slip agents may be employed.

In one embodiment, the polymer into which the slip agent is impregnated includes polyurethane. According to one exemplary embodiment, the slip agent impregnated into the polyurethane is polytetraflourethylene. The polytetraflourethylene comprises a powder. Because the polytetraflourethylene is a solid, it is held firmly in place within the polyurethane matrix. The polytetraflourethylene is at least 2% by weight of the impregnated polyurethane. In particular, it has been found that impregnating the polyurethane with at least 2% by weight of the polytetraflourethylene reduces the adhesion of concrete and other aggregate material to interior surfaces 56 of drum 16. In the exemplary embodiment, the polytetraflourethylene has a percentage by weight of less than 5% of the impregnated polyurethane. As a result, the impregnated polytetraflourethylene does not significantly impact or weaken the polyurethane. In particular embodiments where physical strength of the impregnated polymer are not

required, the polytetraflourethylene may have a greater percentage by weight of the impregnated polyurethane.

According to one exemplary embodiment, the polytetraflourethylene comprises a Teflon powder sold under the mark Zonyl MP-1600 by Dupont, the specifications of which are provided in Appendix C. In other embodiments, other polytetraflourethylenes with other particle sizes or in other forms may be employed. According to one embodiment, the polytetraflourethylene powder is dispersed into a polyol using high sheer mixing with a Cowles blade. In one embodiment, the polytetraflourethylene powder is mixed with the polyol prior to the addition of a prepolymer and a strength additive, Benzoflex. This process results in polytetraflourethylene powder being finely disbursed throughout the polymer (polyurethane) matrix. Because the polytetraflourethylene powder is mixed with the polyol prior to addition of the prepolymer or Benzoflex, the mixture has a lower surface tension which reduces the amount of surface air on the polytetraflourethylene powder and reduces air bubbles formed by coalescence of the air during the polyol/prepolymer reaction. Reducing the number of air bubbles in the impregnated polymer increased the strength of the impregnated polymer (impregnated polyurethane).

According to another embodiment, the slip agent comprises a polyundecene material sold under the mark SYNTON oil by Crompton Corporation, the specifications of which are included in Appendix D. In particular, SYNTON oil is a polyalphaolefin fluid. In the embodiments in which the polyalphaolefin fluid is impregnated into polyurethane and has a percentage by weight of between 2 and 5 percent, the coefficient of friction of interior surfaces 56 will be reduced by approximately 55%. Due to its highly branched structure, migration of the polyalphaolefin fluid within the polyurethane matrix is relatively slow. As a result, the fluid does not significantly migrate towards layer 76. In one particular embodiment, the polyalphaolefin fluid has a percent by weight of at least 1% of the impregnated polymer (polyurethane). As a result, concrete adherence to surface 56 is light. In another embodiment, the polyalphaolefin fluid has a percent by weight of at least 2% of the impregnated

polymer, resulting in the impregnated polymer having imperceptible concrete adherence to surface 56. In one embodiment, the polyalphaolefin fluid has a percent by weight no greater than 5% of the impregnated polymer. As a result, the physical properties of the polyurethane are not substantially affected. In particular applications, the polyalphaolefin fluid may have a greater percent by weight of the impregnated polymer where required physical properties of the polymer are not as stringent. Polyalphaolefin fluid significantly reduces the coefficient of friction of the polyurethane at levels which do not substantially degrade the physical strength or structural qualities of the polyurethane. In addition, the polyalphaolefin fluid does not entrain air during its impregnation or addition to the polymer. The chart below indicates physical qualities of the impregnated polyurethane (provided by ERA polymers) when impregnated with 1%, 2% and 5% by weight polytetraflourethylene powder (Zonyl MP-1600N) and the impregnated polyurethane when impregnated with a polyalphaolefin fluid (SYNTON oil 100) at levels of 1%, 2% and 5% by weight.

Test	Units	Control	PTFE (MP-1600)			Synton Oil 100		
			1%	2%	5%	1%	2%	5%
Hardness Shore A	Shore A	90.2	89.6	88.4	88.3	89.1	89	89.5
Tensile Strength	MPa	17.8	16.8	16.6	10.8	17.1	15.7	16.7
Modulus 100%	MPa	9.7	9.4	8.7	8.3	9.1	9	8.6
Modulus 200%	MPa	11.1	11.1	10.4	9.4	10.9	10.6	10.3
Modulus 300%	MPa	12.7	12.8	12.1	10.3	12.5	12.2	12.2
Elongation at Break	%	546	485	507	338	506	482	491
Tear Strength	kN/m	75.2	72.1	68.4	65.6	72.2	70.8	69.4
Peel Strength (90 deg/neat)	ppl	137	69	62	63	116	113	121
Peel Strength (90 deg/split)	ppl	98	67	50	57	74	80	83
Peel Strength (180 deg/Crtn)	ppl	92.5	91.7	88.9	88.3			
Peel Strength (180 deg/Dex)	N	178	274	276	135	71	93	102
Seam Strength	N	1210	2273	2433	2055	1579	2197	2175
NBS Abrasion (Avg. 2 sets)	index	1061	1363	1419	1196	1865	1878	1569
DIN Abrasion (Avg. 2 sets)	index	323	332	311	325	415	386	353
COF (Static)		0.65	0.42	0.37	0.36	0.4	0.29	0.29
C OF (Dynamic)		0.72	0.45	0.38	0.34	0.38	0.35	0.5
Texus Flox	cycles (7 days/14 days	<500/1360	<500/4430	<500/2170	<500/500	<500/4770	<500/3730	<500/3500
Concrete Adhesion	Qualitative Adhesion	Firmly	Firmly	Lightly	None	Lightly	None	None

Overall, because layer 74 is formed from a polymer impregnated with a slip agent, layer 74 which forms interior surfaces 56 of drum 16 has a lower coefficient of friction and adheres less to concrete or other aggregate being mixed within drum 16.

During mixing of concrete and aggregate, surfaces 56 are normally abraded, forming small grooves and scratches in which concrete forms a mechanical lock and hardens. However, due to its lower coefficient of friction, surface 56 impedes the collection of concrete or other aggregate within such scratches. Moreover, because the slip agent is impregnated or at least partially disbursed throughout the polymer to form layer 74, layer 74 is sufficiently durable so as not wear at an excessive rate as compared to a layer consisting solely of a slip agent such as polytetraflourethylene. In addition, the structural strength of other physical qualities of the polymer are maintained and used in particular embodiments. Although particular examples have been provided describing the use of polytetraflourethylene or a polyalphaolefin fluid impregnated into a polymer such as polyurethane, other polymers and other slip agents may alternatively be employed at various relative concentrations depending upon the required physical qualities of the impregnated polymer. Although layer 74 is described as comprising a polymer impregnated with a slip agent to reduce the coefficient of friction and adherence of the resulting material, layer 74 may alternatively be formed by a slip agent, such as polytetraflourethylene, impregnated with a strength or durability agent, wherein the strength or durability agent is in a substance which, when added to the slip agent, increases the strength or durability of the slip agent.

In the particular embodiment illustrated, layer 74 extends along interior surface 58 or barrel 30 as well as exterior surfaces 60 of projections 32. As shown by FIGURE 4, in one particular embodiment, layer 74 forms an entire thickness of projection 32 at a radial mid-portion of projection 32. As shown by FIGURES 2 and 3, layer 74, which provides interior surface 56 of drum 16, is provided by two elongate archimedial or helical sections 80, 82. Each section 80, 82 provides an interior surface 58 of barrel 30 and provides a projection 32. Sections 80 and 82 are spirally wrapped or screwed to one another with their edges extending adjacent or to close proximity with one another.

After sections 80 and 82 are positioned adjacent to one another, such sections 80 and 82 each extend substantially from end 40 to end 42, layer 76 is formed in a continuous

integral fashion from end 40 to end 42 over sections 80 and 82 and across the seams between sections 80 and 82. In one particular embodiment, layer 76 is formed from fiberglass windings which are coated with resin and wrapped or wound over and around layer 74 and sections 80 and 82. In one embodiment, the resin is Hetron 942, available from Ashland Chemical, in Dublin, Ohio, and the fibers are fiberglass, preferably 2400 Tex E glass (approximately 206 yards per pound). The angles at which the fibers are wound about layer 74 at the major axis (location at which barrel 30 as a greatest diameter) is approximately 10.5 degrees relative to the central axis of barrel 30. During the winding process, the resin coated fiber windings are wrapped generally from one end of the drum to the other. The ribbon of the windings is wrapped around the drum such that there is approximately 50% overlap between each pass of the ribbon. The wrapping of the fibers or windings from end to end provide drum 16 with structural support to withstand various forces in various directions. A more detailed discussion of sections 80, 82, projections 32 and the fiberglass windings of layer 76 is provided in copending International Patent Application Serial No. PCT/US03/25656 entitled Mixing Drum, the full disclosure of which is hereby incorporated by reference and which is attached as Appendix A and copending International Patent Application Serial No. PCT/AU03/00664 filed on May 31, 2003 by Anthony Khouri entitled Vehicle Mounted Concrete Mixing Drum and Method of Manufacture Thereof, wherein the entirety of International Patent Application Serial No. PCT/AU03/00664 is hereby incorporated by reference and is attached as Appendix E. Layer 74 of the present application is similar to the interior polymer layer forming the interior surface of the drum and projections described in copending International Patent Application Serial No. PCT/US03/25656 and copending International Patent Application Serial No. PCT/AU03/00664 except that such layer 74 is impregnated with a slip agent.

FIGURE 5 is a greatly enlarged fragmentary sectional view of layers 74 and 76 along barrel 30. FIGURE 5 illustrates a process for finishing exterior surfaces 48 and 50 of barrel 30 such that the exterior surface of drum 16 is smoother, facilitating improved application of paint, labels, decals or other aesthetic layers upon layer 76 and further facilitating improved cleaning of the exterior of drum 16 by reducing concrete

adherence to the exterior of drum 16. As shown by FIGURE 5, layer 74 includes the impregnated polymer layer 90 comprising a polymer impregnated with a slip agent (as described above) and a layer 92 of glass reinforced plastic which bonds to layer 90 during the molding of sections 80 and 82. As described in copending International Patent Application PCT/AU03/00664, layer 92 is positioned along the interior of the molds. Thereafter, the liquid polymer (in this case, the liquid impregnated polymer) is injected into the molds wherein the polymer impregnated with the slip agents bonds to layer 92 and is thereafter removed from the mold and mounted to a jiggor fixture as described above.

As shown by FIGURE 5, layer 76 includes sublayer 94 comprising the resin coated fiberglass windings which are wrapped about layer 74 as described in copending International Patent Application PCT/AU03/00664. However, the outermost exterior surface of layer 94 is generally extremely course, making painting, coating or application of aesthetic decals difficult. As shown by FIGURE 5, layer 76 is further finished by applying a sacrificial layer 96 over layer 94, grinding a preliminary exterior surface 98 to a smooth finish and then applying a top layer 100 over surface 98 to provided final exterior surface 102 of layer 76 which is smooth and more susceptible to being painted, to having decals applied to it or to being otherwise coated by additional nonstructural layers.

In one particular embodiment, sacrificial layer 96 comprises chopper fiberglass, including strands of fiberglass having lengths of approximately 2 inches. During its application, the chopper fiberglass forms air pockets. Grinding of layer 96 cuts through the air pockets to expose a plurality of depressions, pinholes or pores 104 along preliminary surface 98. Top layer 100 extends over and across pores 104 to form a smooth bridge over pores 104. Material chosen for top layer 100 has a sufficient stiffness so as to not sag into pores 104 but to alternatively bridge across pores 104. In one particular embodiment, top layer 100 comprises chopper fiberglass. Layer 100 generally has a thickness much less than the thickness of sacrificial layer 96. In one embodiment wherein layers 96 and 100 each comprise chopper fiberglass, layer 96 has a thickness of up to 0.25 inch while top layer 100 has a maximum

thickness of 0.05 inch. The resulting finished surface 102 omits pores or pinholes which would otherwise receive concrete, making cleaning of the exterior drum 16 difficult. Moreover, layer 100 further prevents concrete from being deposited in the pinholes where it would otherwise expand and potentially crack the surface of drum 16. In the particular embodiment illustrated, sacrificial layer 96 is ground using an abrasive having at least 16 grits. In one embodiment, sacrificial layer 96 is ground using a 16 grit sanding belt.

Overall, mixing drum 16 is lighter in weight for the volume or aggregate that it can carry as compared to conventional steel front discharge drums. In addition, because snout portion 46 is integrally formed with main portion 44, drum 16 has a barrel 30 that has a continuous and smooth interior surface 58 as well as a continuous and relatively smooth exterior surface 54 transitioning between main portion 44 and snout portion 46. As a result, both the interior and exterior surfaces of barrel 30 of drum 16 lack joints, corners or other surface discontinuities (excluding drive ring 36 and projection 32) where concrete or aggregate can collect and make cleaning difficult. The cleanability of drum 16 is further enhanced by the use of a polymer impregnated with a slip agent to provide interior surface 56 of drum 16. Both the interior surface 58 of barrel 30 as well as the exterior surface 60 of projections 32 are at least partially formed from the impregnated polymer to reduce coefficient of friction and to reduce concrete adherence. At the same time, the impregnated polymer substantially maintains the same physical qualities as compared to the unimpregnated polymer.

The exterior surfaces 48, 50 and 54 are also resistant to concrete adherence and are sufficiently smooth for an improved aesthetic appearance and for facilitating additional aesthetic layers such as paint, coatings or decals to be further applied. In particular, the sacrificial layer 96 fills in and bridges across the larger depressions or valleys along the exterior of layer 94 (provided by resin wetted fiberglass windings). The preliminary exterior surface 98 of sacrificial layer 96 is further ground to a smoother finish. In one particular embodiment in which the sacrificial layer 96 is chopper fiberglass, this results in pinholes or pores 104 along preliminary exterior

surface 98. Top layer 100 fills in and bridges over such pinholes or pores to produce a finished surface 102.

In alternative embodiments, layer 76 may be finished with other techniques and/or materials. For example, sacrificial layer 96 may be provided by a material which does not result in the formation of pinholes or pores upon being ground. In such an alternative embodiment, top layer 100 may be omitted. In still,anther embodiment, sacrificial layer 96 may be omitted where the exterior of layer 94 is ground (*i.e.*, sanded) and where in top layer 100 is applied directly to layer 94. In such an application, layer 94 should preferably have a thickness or a sufficient strength so as to meet the strength requirements of drum 16 after portions of layer 94 are sacrificed.

Drum 16 is illustrated as including a combination of several features which synergistically enhance the performance of drum 16. In other embodiments or applications, these features ma be employed independent of one another or in different combinations. For example, although layer 74 formed from the polymer impregnated with the slip agent (or alternatively the slip agent impregnated with the strength/durability agent) is illustrated as integrally forming both interior surface 58 of barrel 30 and exterior surface 60 of projection 32, in other embodiments, layer 74 may alternatively only form interior surface 58 of barrel 30. In still another embodiment, layer 74 may only form the exterior surface 60 of projections 32. Although layer 74 is illustrated as integrally forming projection 32 with barrel 30, projection 32 alternatively comprise a separately formed structure which is fastened or bonded to barrel 30. In such an alternative application, one or both of interior surface 58 of barrel 30 and exterior surface 60 of projection 32 may still include the impregnated polymer.

Although layer 74 is illustrated as being utilized in a front discharge concrete mixing drum 16, layer 74 with the polymer impregnated with a slip agent may alternatively be employed in a rear discharge drum such as is described in copending International Patent Application Serial No. PCT/US03/25656 (see Appendix A). Although layer 74 is illustrated as being utilized in a concrete mixing drum (front discharge or rear

discharge) formed from at least two archimedial helical sections which form the interior of the drum, the impregnated polymer may alternatively be used in a drum in which the interior surface 56 of the drum is simultaneously molded. For example, in the mixing drum disclosed in copending U.S. Application Serial No. 10/049,605 filed on October 9, 2000 by Anthony Khouri and William Rodgers and entitled VEHICLE MOUNTED PLASTICS DRUM FOR CONCRETE MIXING AND METHODS OF MANUFACTURE THEREOF, the full disclosure of which is incorporated by reference and attached as Appendix G, the polymer disclosed as providing the interior surface of the drum (unimpregnated polyurethane) may be replaced with a polymer impregnated with a slip agent such as an impregnated polyurethane.

Although layer 74 formed from the polymer impregnated with a slip agent is described as being utilized in conjunction with a layer exterior to layer 74 which is formed from fiberglass, layer 74 may alternatively be utilized in conjunction with a layer exterior to layer 74 formed from one or more other materials. For example, layer 74 may alternatively be utilized with an additional layer exterior to layer 74 formed from a metal. In lieu of being molded, the polymer impregnated with the slip agent may alternatively be coated upon layer 76. In one embodiment, layer 74 may be coated upon a layer 76 formed from one or more non-metal materials such as fiberglass. In another embodiment, layer 74 may be coated upon layer 76 formed from a metal such as steel.

Although layer 74 is illustrated as continuously extending from end 40 to end 42, layer 74 may alternatively be molded into sections which do not extend from end 40 to end 42 or may be coated or otherwise applied to layer 76 which itself does not continuously extend from end 40 to end 42. For example, layer 76 may alternatively be formed from generally annular sections (but for end 42 which would be closed) formed from a non-metal material such as fiberglass or a metal material such as steel, which are bonded or fastened to one another. In such an application, layer 74 may be coated upon the annular sections, such as by spraying, either after the sections are assembled together or before the sections are assembled together or may be fastened to the sections after the sections are fastened together or before the sections are

fastened together. In one embodiment, layer 74 may be formed as a section and may be fastened to layer 76 which is in sections so as to overlap or bridge across the seams between the sections of layer 76 along the interior of the drum for improved strength. As mentioned above, in those applications wherein the structural requirements of layer 74 are less stringent, such as when layer 74 is coated or sprayed to an existing drum, the amount or percentage of slip agent impregnated into the polymer may be increased.

Although projection 32 is illustrated as having the shape and configuration shown in FIGURES 2 through 4, projection 32 and alternatively have other configurations and may be formed by other techniques. For example, projection 32 may alternatively be configured and formed as shown in copending U.S. Patent Application Serial No. 10/049,605, the full disclosure which is hereby incorporated by reference. In still other embodiments, projection 32 may be formed from other materials and other processes.

Although the finishing process described with respect to FIGURE 5 is illustrated in conjunction with finishing the exterior of barrel 30 of drum 16, this finishing process may also be utilized in other drums having an exterior surface (prior to painting, decals and the like) that is provided by fiberglass or other materials which result in a relatively rough textured surface. For example, the finishing process may also be utilized to finish the exterior surface of the drum formed according to copending U.S. Patent Application Serial No. 10/049,605, the full disclosure of which is hereby incorporated by reference. Although the entire exterior surface of barrel 30 of drum 16 is described as being finished according to the process discussed with respect to FIGURE 5, this finishing process may alternatively be formed along only selected areas of the surface of barrel 30.

Although the present invention has been described with reference to example embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention. For example, although different example embodiments may have been described as

including one or more features providing one or more benefits, it is contemplated that the described features may be interchanged with one another or alternatively be combined with one another in the described example embodiments or in other alternative embodiments. Because the technology of the present invention is relatively complex, not all changes in the technology are foreseeable. The present invention described with reference to the example embodiments and set forth in the above definitions is manifestly intended to be as broad as possible. For example, unless specifically otherwise noted, the definitions reciting a single particular element also encompass a plurality of such particular elements.

DEFINITIONS

Definition 1: A rotary concrete mixing drum configured to be coupled to a vehicle having the drive for rotating the drum, a drum comprising:

an interior surface at least partially provided by a polymer impregnated with a slip agent.

Definition 2: The drum of definition 1 wherein the polymeric includes polyurethane.

Definition 3: The drum of definition 1 wherein the slip agent has a surface energy less than the surface tension of a Portland Cement low slump concrete.

Definition 4: The drum of definition 1 wherein the slip agent has a surface energy of less about 20 dynes per centimeter.

Definition 5: The drum of definition 1 wherein the slip agent is a polyundecene.

Definition 6: The drum of definition 1 wherein the slip agent is a polyalphaolefin fluid.

Definition 7: The drum of definition 1 wherein the slip agent is polytetraflourethylene.

Definition 8: The drum of definition 1 wherein the polymeric material is polyurethane, wherein the slip agent is polytetraflourethylene and wherein at least 2% by weight of the impregnated polymer is polytetraflourethylene.

Definition 9: The drum of definition 8 wherein no greater than 5% by weight of the impregnated polymer along the surface is polytetraflourethylene.

Definition 10: The drum of definition 1 wherein the polytetraflourethylene is about 2% by weight of the impregnated polymer along the surface.

Definition 11: The drum of definition 1 wherein the polymer is polyurethane and wherein the slip agent is a polyalphaolefin.

Definition 12: The drum of definition 11 wherein no greater than 5% of weight of the impregnated polymer is the polyalphaolefin.

Definition 13: The drum of definition 12 wherein at least 2% by weight of the impregnated polymer is the polyalphaolefin.

Definition 14: The drum of definition 11 wherein at least 2% by weight of the impregnated polymer is the polyalphaolefin.

Definition 15: The drum of definition 11 wherein the polyalphaolefin comprises about 3% by weight of the impregnated polymer along the surface.

Definition 16: The drum of definition 1 wherein the slip agent is configured so as to not substantially migrate within the polymer.

Definition 17: The drum of definition 1 including:

an inner layer including the impregnated polymer along the inner surface; and

an outer layer providing an exterior surface of the drum.

Definition 18: The drum of definition 17 wherein the outer layer is non-metallic.

Definition 19: The drum of definition 18 wherein the outer layer includes fiberglass.

Definition 20: The drum of definition 19 wherein the outer layer includes:

fiberglass windings about the inner layer;

a first layer of chopper fiberglass over the windings, the first layer having a ground surface with pores; and

a second layer of chopper fiberglass over the first layer and across the pores.

Definition 21: The drum of definition 20 wherein the first layer has a first thickness and wherein the second layer has a second lesser thickness.

Definition 22: The drum of definition 20 wherein the first layer has a thickness of about 0.25 inch and wherein the second layer has a thickness of about 0.05 inch.

Definition 23: The drum of definition 20 wherein the second layer has a thickness of about 0.1 inch.

Definition 24: The drum of definition 20 wherein the ground surface has a smoothness from being ground by a 16 grit abrasive.

Definition 25: The drum of definition 17 wherein the outer layer includes:

fiberglass windings about the inner layers;

a sacrificial layer over the windings, wherein the sacrificial layer has a surface having pores; and

a top layer over the sacrificial layer and across the pores.

Definition 26: The drum of definition 17 wherein the outer layer is metallic.

Definition 27: The drum of definition 1 wherein the impregnated polymer has a tensile strength of at least 15 MPa.

Definition 28: The drum of definition 1 wherein the impregnated polymer has a Modulus 300% of at least 12 MPa.

Definition 29: The drum of definition 1 wherein the impregnated polymer has a tear strength of at least 68 kN/m.

Definition 30: The drum of definition 1 including inwardly extending projections configured to move material as the drum is rotated, wherein the projections partially provide the interior surface of the drum.

Definition 31: The drum of definition 30 wherein the projections have an exterior surface including the impregnated polymer.

Definition 32: The drum of definition 31 wherein at least a portion of one of the projections has a thickness completely formed from the impregnated polymer.

Definition 33: A fin for use in a concrete mixing drum, the fin comprising:

an exterior surface at least partially provided by a polymer impregnated with a slip agent.

Definition 34: A drum barrel for a concrete mixing drum, the barrel comprising:

an interior surface at least partially provided by a polymer impregnated with a slip agent.

Definition 35: A method for forming a concrete mixing drum, the method comprising:

impregnating a polymer with a slip agent; and

forming an interior surface of a concrete mixing drum with the impregnated polymer.

Definition 36: The method of definition 35 including molding the impregnated polymer.

Definition 37: The method of definition 35 including spraying the impregnated polymer.

Definition 38: The method of definition 34 wherein the slip agent includes polytetraflourethylene.

Definition 39: The method of definition 37 wherein impregnating includes mixing polytetraflourethylene powder with polyol.

Definition 40: The method of definition 39 wherein mixing comprises high sheer mixing.

Definition 41: The method of definition 40 wherein mixing is performed using a Cowles blade mixer.

Definition 42: The method of definition 35 including:

molding the impregnated polymer into a first section;

forming an interior of the drum with the section; and

applying fiberglass to an exterior of the first section.

Definition 43: The method of definition 42 including:

molding the impregnated polymer into a second section;

coupling the second section to the first section to form the interior of the drum; and

applying fiberglass windings to an exterior of the second section.

Definition 44: The method of definition 43 wherein the first section and the second section are helical and wherein coupling includes screwing the first section and the second section together.

Definition 45: The method of definition 43 including:

applying a sacrificial layer of fiberglass over the windings;

grinding the sacrificial layer to form a ground exterior surface having pores; and

applying a top layer of fiberglass over the ground exterior surface.

Definition 46: A method for finishing an exterior of a concrete mixing drum having a preliminary exterior surface, the method comprising:

applying a sacrificial layer of fiberglass over the preliminary exterior surface;

grinding the sacrificial layer to form a ground surface having pores; and

applying a top layer on the ground surface over the pores.

Definition 47: The method of definition 46 wherein the sacrificial layer is ground using an abrasive having at least a 16 grit.

Definition 48: The method of definition 46 wherein the top layer is chopper fiberglass.

Definition 49: The method of definition 48 wherein the top layer has a thickness of less than 0.50 inch.

Definition 50: A concrete mixing truck comprising:

a chassis;

a cab supported by the chassis;

a drum supported by the chassis and extending over the cab, the drum having the first section extending in an archimedial spiral along an axial center line of the drum; and

a second section extending in an archimedial spiral along the axial center line of the drum, wherein the first section and the second section extend adjacent to one another.

Definition 51: A concrete mixing drum comprising:

a barrel having an inner surface and an outer surface; and

at least one projection spirally extending along the inner surface, wherein the inner surface is provided by a polymer and wherein the outer surface has a convex portion and a concave portion.

Definition 52: The drum of definition 51 wherein the concave portion is located along an axial midsection of the drum.

Definition 53: The drum of definition 51 wherein the convex portion and the concave portion are integrally formed as a single unitary body.

Definition 54: The drum of definition 53 wherein the convex portion and the concave portion are formed from fiberglass windings.

Definition 55: The drum of definition 51 wherein the inner surface is at least partially provided by a first archimedial section.

Definition 56: The drum of definition 51 wherein the projections are integrally formed as a single unitary body with the inner surface of the barrel.

Definition 57: The drum of definition 55 wherein the inner surface is provided by a second archimedial section screwed about the first section, wherein the first section and the second section each have an exterior mid-portion concave surface.

Definition 58: A rotary concrete mixing drum comprising: an interior surface at partially provided by a material including one of a slip agent or strength-durability agent impregnated within the other of the slip agent or strength/durability agent.

FIG. 1

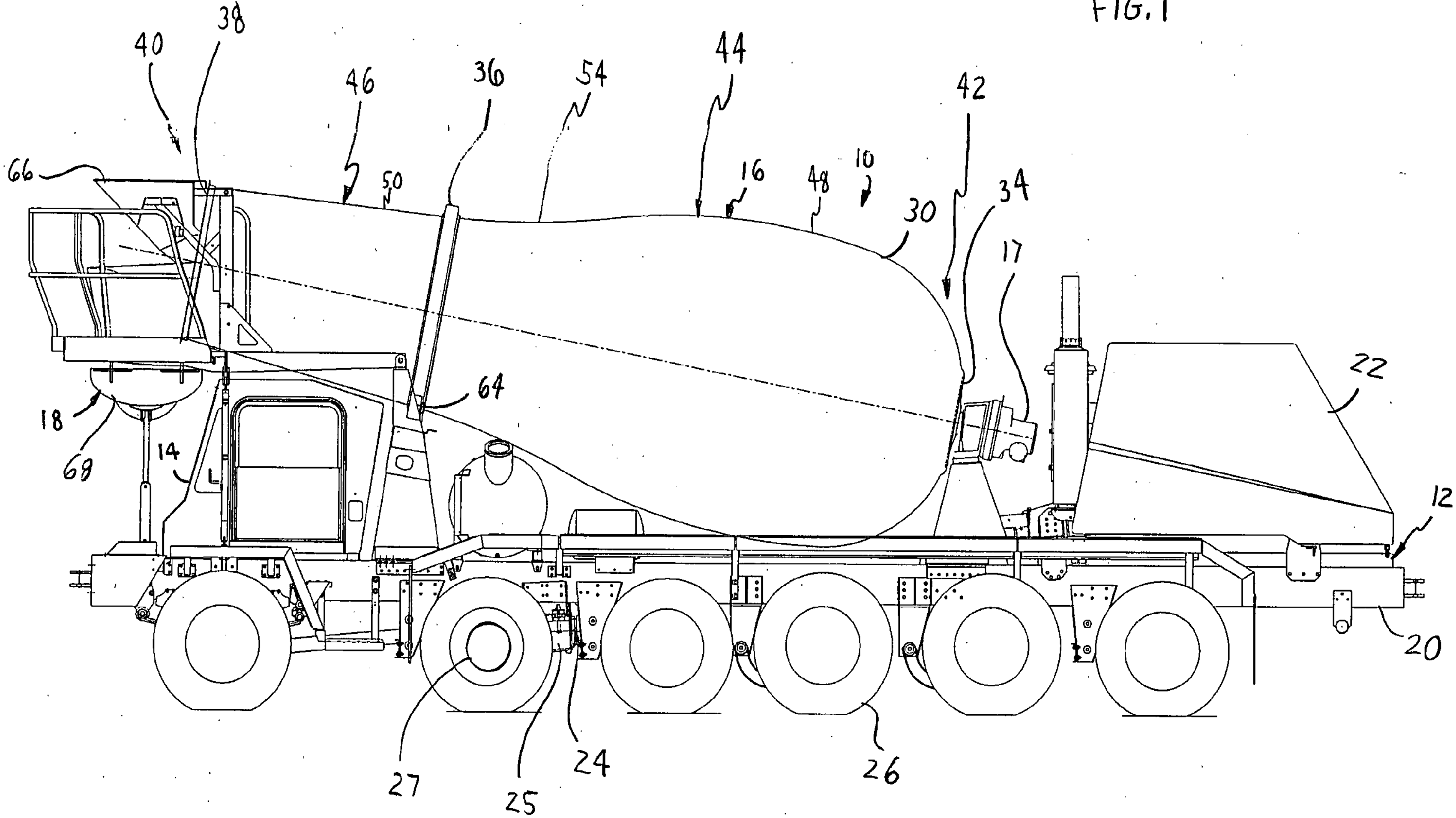

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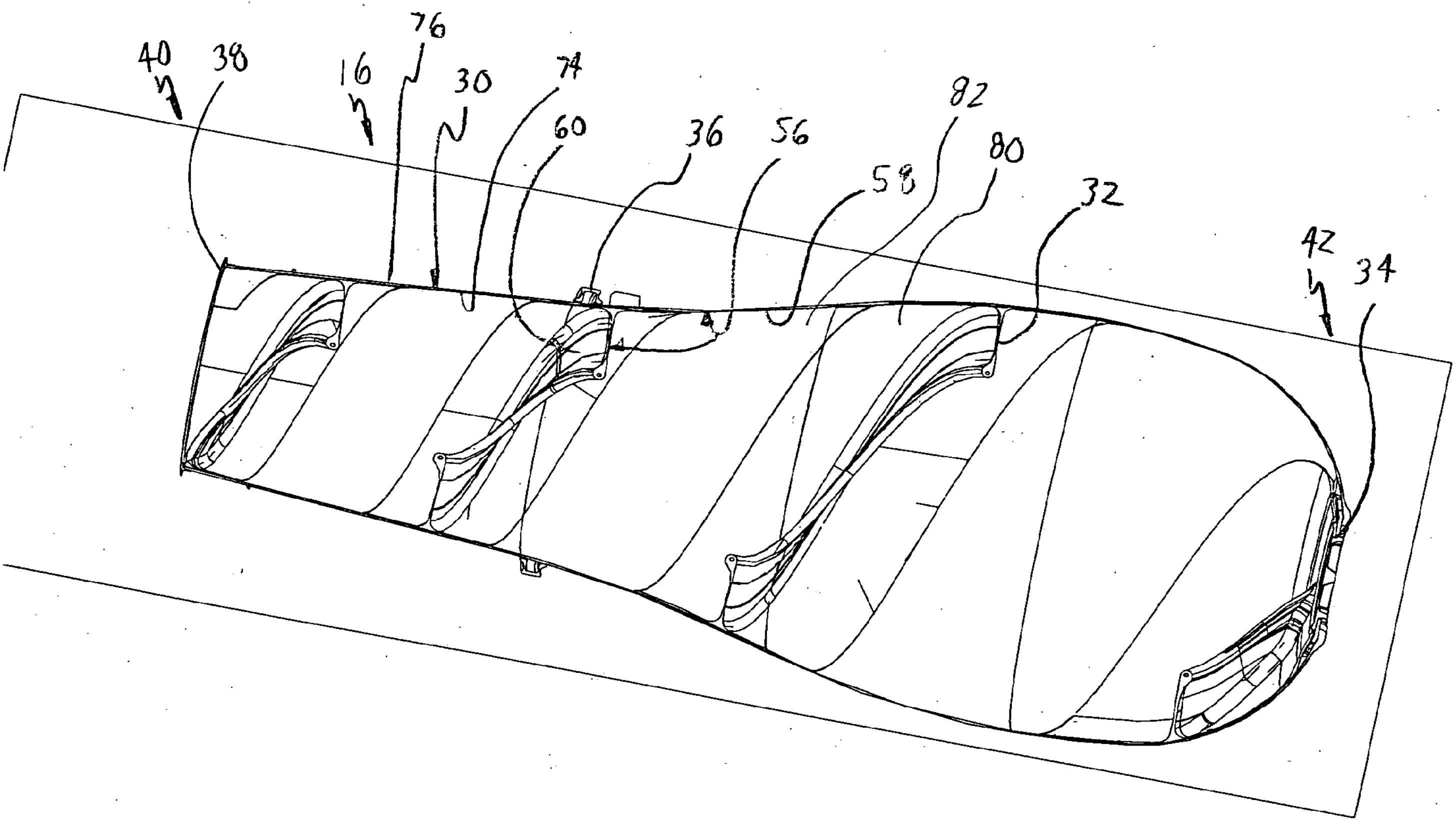
FIG. 2



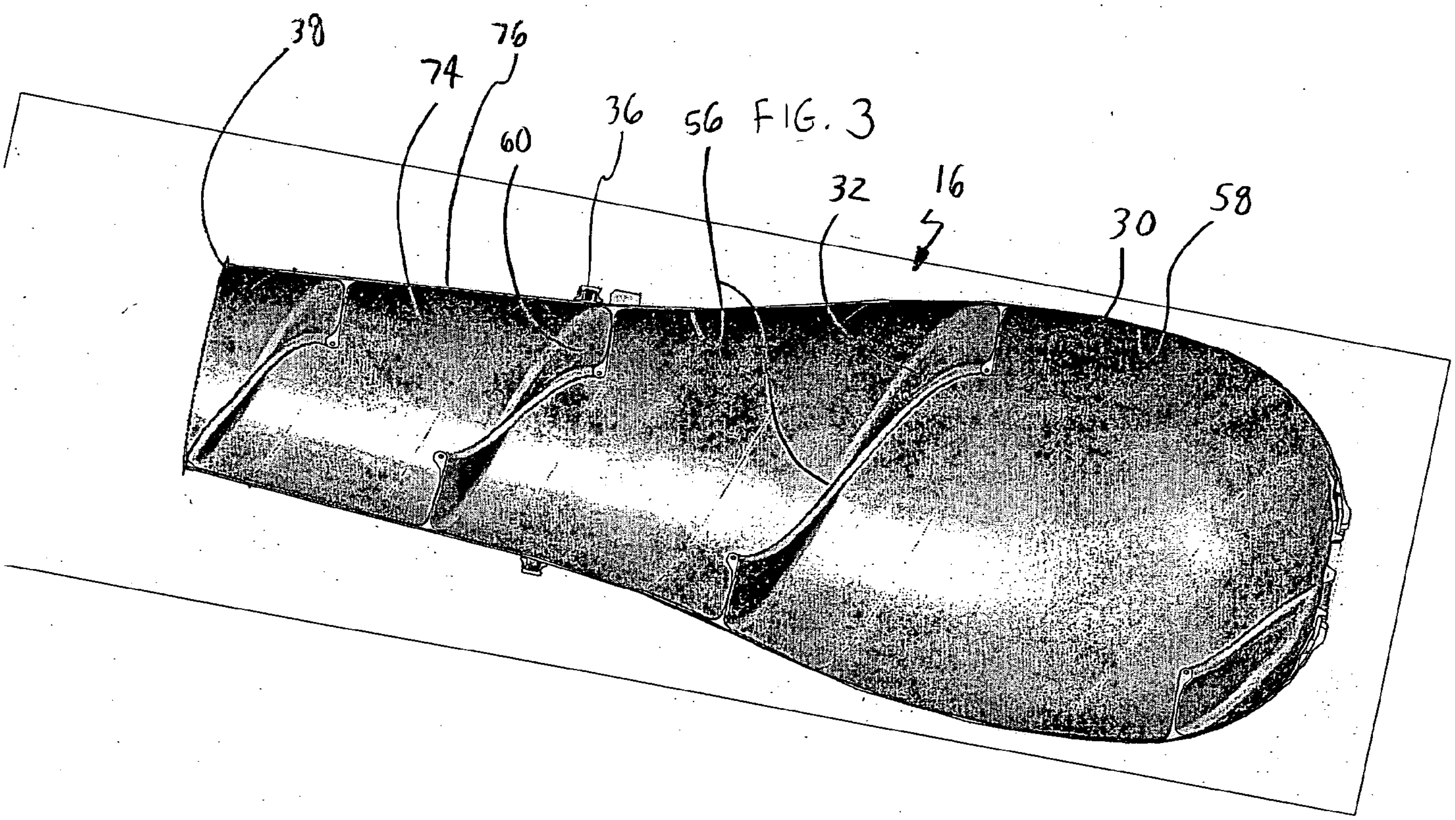


FIG. 3

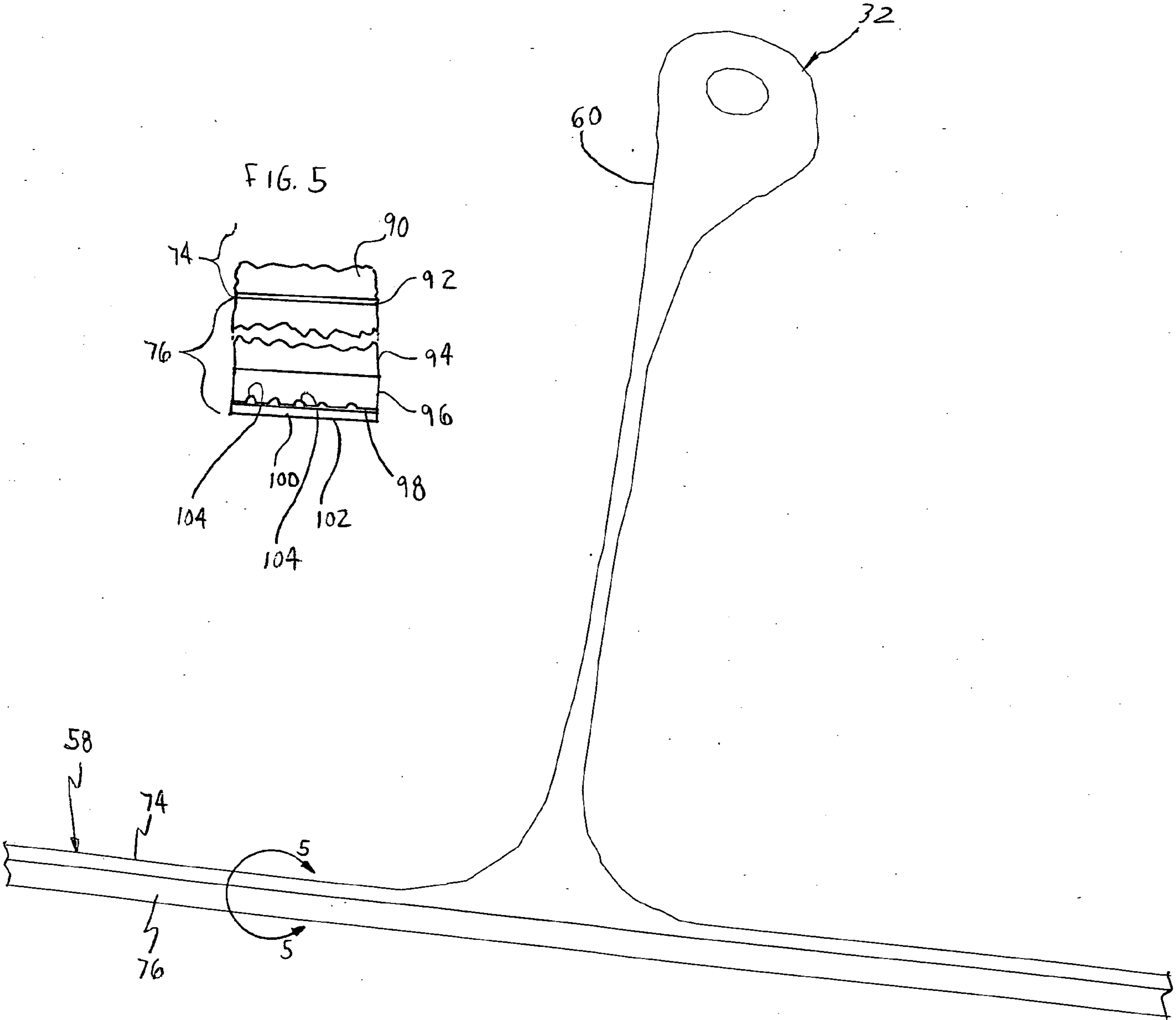


FIG 4

Application Data Sheet

Application Information

Application Type::	Provisional
Subject Matter::	Utility
Suggested classification::	
Suggested Group Art Unit::	
CD-ROM or CD-R?::	None
Computer Readable Form (CRF)?::	No
Title::	MIXING DRUM
Attorney Docket Number::	061300-0615
Request for Early Publication?::	No
Request for Non-Publication?::	No
Suggested Drawing Figure::	1
Total Drawing Sheets::	4
Small Entity?::	No
Petition included?::	No
Secrecy Order in Parent Appl.?::	No

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State or Province of mailing address::	MN
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Domestic Priority Information

Application::	**Continuity Type::**	**Parent Application::**	**Parent Filing Date::**

Foreign Priority Information

Country::	**Application number::**	**Filing Date::**	**Priority Claimed::**

Assignee Information

Assignee name::